This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (Previously Presented) A method of designing a two-mirror high numerical aperture imaging device comprising the steps of:

(a) determining the positioning of each consecutive point of a cross-section through the x-axis of a first mirror and a second mirror, iteratively for a cross-section in the plane $z=0$, where the x and y coordinates of each successive point on the two mirrors in the cross-section are $M_1(t) \equiv (m_{1,x}(t), m_{1,y}(t), 0)$ (for the first mirror) and $M_2(t) \equiv (m_{2,x}(t), m_{2,y}(t), 0)$ (for the second), t being an iteration counter; where the functions $M_0(t) \equiv (m_{0,x}(t), m_{0,y}(t), 0) \equiv (f, 0, 0)$ and $M_3(t) \equiv (m_{3,x}(t), m_{3,y}(t), 0) \equiv (0,0,0)$ are set to define the centres of the object and image planes respectively;

(b) Calculating the angle $d_i(t)$ (for $i = 0, \ldots, 2$) that a ray from $M_i(t)$ to $M_{i+1}(t)$ makes to the x-axis, i.e.

$$d_i(t) = \arctan\left(\frac{m_{i+1,y}(t) - m_{i,y}(t)}{m_{i+1,x}(t) - m_{i,x}(t)}\right)$$

(c) Calculating the distance $p_i(t)$ (for $i = 0, \ldots, 2$) between $M_i(t)$ and $M_{i+1}(t)$, i.e.

$$p_i(t) = \sqrt{(m_{i+1,x}(t) - m_{i,x}(t))^2 + (m_{i+1,y}(t) - m_{i,y}(t))^2}$$

(d) Calculating the angle $a_i(t)$ that a tangent to the i'th surface makes to the x-axis, taking $a_0(t)$ and $a_3(t)$ to be the angles that the object and image planes make to the x-axis (being 90° for all t for the surfaces to be rotationally symmetric about the x-axis), i.e. for reflection (for $i = 1$ and 2):

$$a_i(t) = \frac{d_i(t)}{2} + \frac{d_{i-1}(t)}{2}$$

(e) Choosing the values of $m_{i,x}(0)$ and $m_{i,y}(0)$ (for $i = 1$ and 2) so that the resulting mirror layout satisfies the sine criterion, and wherein for a far away source (say along the negative x-axis, say $f = -10^9$) a scale parameter, b may be set equal to unity (without loss of generality, such that $B = b/p_0(0) = 1/p_0(0)$), and wherein the sine criterion is then satisfied if:

$$m_{1,y}(0) = \pm \frac{m_{2,y}(0)}{\left(m_{2,x}(0)^2 + m_{2,y}(0)^2\right)^{1/2}}$$

(f) Iterating either from shallower angles to more oblique angles, or vice versa (switching between the two being achieved by using as seed values later iterated results and reversing the sign of the iteration step size h), such that if the iteration is from highly oblique angles then set $m_{2,x}(0)$ equal to a small number close to zero, say 10^{-9}, and choose $m_{1,x}(0) = q_1$ and $m_{2,y}(0) = q_2$, where q_1 and q_2 are arbitrary real numbers (positive or negative), but with the choice of signs of q_1, q_2 and h constrained so as not to have simultaneously the sign of q_1 negative, the sign of q_2 positive and the sign of h positive, then $m_{1,y}(0)$ will need to be ± 1 for the initial parameters to satisfy the sine criterion, and without loss of generality it is possible to choose $m_{1,y}(0)$ to be -1;

(g) Choosing the sign Z so that the sine criterion remains satisfied as t changes;

(h) Updating the values of $M_i(t)$ as follows (for a small value of h):

$$M_i(t+1) \equiv \begin{pmatrix} m_{i,x}(t+1) \\ m_{i,y}(t+1) \end{pmatrix} = M_i(t) + w_i \begin{pmatrix} \cos(a_i(t)) \\ \sin(a_i(t)) \end{pmatrix} h$$

where $r_{i-1}(t) = \sin(a_{i-1}(t) - d_{i-1}(t))$ $s_i(t) = \sin(a_i(t) - d_{i-1}(t))$ and where

$$w_2 = \frac{p_1 r_0}{p_0 s_2} \quad w_1 = -ZB\frac{p_1 s_3}{p_2 r_1}$$

(i) Ending the iteration no later than when light rays cease to be able to pass freely through the mirror arrangement, once it has been rotated as in (j); and

(j) Rotating the curves produced above around the x-axis to define the complete, three-dimensional mirror surfaces.

2. (Previously Presented) A method of designing a two-mirror high numerical aperture imaging device according to claim 1 wherein q_1, q_2, and h are selected from the group consisting of ($q_1 > 0$, $-1 < q_2 < 0$ and $h < 0$); ($q_1 > 0$, $0 < q_2 < 1$ and $h > 0$); ($q_1 > 0$, $0 < q_2 < 1$ and $h < 0$); ($q_1 > 0$, $-1 < q_2 < 0$ and $h > 0$); ($q_1 > 0$, $-1 < q_2 < 0$ and $h > 0$); ($q_1 < 0$, $0 < q_2 < 1$ and $h < 0$); ($q_1 < 0$, $-1 < q_2 < 0$ and $h > 0$); ($q1 < 0$, $-1 < q2 < 0$ and $h < 0$); ($q_1 > 0$, $q_2 > 1$ and $h > 0$); ($q_1 > 0$, $q_2 > 1$ and $h < 0$); ($q_1 > 0$, $q_2 < -1$ and $h > 0$); ($q_1 > 0$, $q_2 < -1$ and $h < 0$); ($q_1 < 0$, $q_2 > 1$ and $h < 0$); ($q_1 < 0$, $q_2 < -1$ and $h > 0$); and ($q_1 < 0$, $q_2 < -1$ and $h < 0$).

3-18. Cancelled.

19. (Previously Presented) A high numerical aperture imaging device comprising:

a first mirror and a second mirror, wherein the positioning of each consecutive point of a cross-section through the *x*-axis of a first mirror and a second mirror is determined iteratively for a cross-section in the plane $z=0$, where the *x* and *y* coordinates of each successive point on the two mirrors in the cross-section are $M_1(t)\equiv(m_{1,x}(t),m_{1,y}(t),0)$ (for the first mirror) and $M_2(t)\equiv(m_{2,x}(t),m_{2,y}(t),0)$ (for the second), *t* being an iteration counter; where the functions $M_0(t)\equiv(m_{0,x}(t),m_{0,y}(t),0)\equiv(f,0,0)$ and $M_3(t)\equiv(m_{3,x}(t),m_{3,y}(t),0)\equiv(0,0,0)$ are set to define the centres of the object and image planes respectively;

wherein the angle $d_i(t)$ (for $i = 0, \ldots, 2$) that a ray from $M_i(t)$ to $M_{i+1}(t)$ makes to the *x*-axis is given by:

$$d_i(t)=\arctan\left(\frac{m_{i+1,y}(t)-m_{i,y}(t)}{m_{i+1,x}(t)-m_{i,x}(t)}\right)$$

wherein the distance $p_i(t)$ (for $i = 0, \ldots, 2$) between $M_i(t)$ and $M_{i+1}(t)$ is given by:

$$p_i(t)=\sqrt{(m_{i+1,x}(t)-m_{i,x}(t))^2+(m_{i+1,y}(t)-m_{i,y}(t))^2}$$

wherein the angle $a_i(t)$ that a tangent to the *i*'th surface makes to the *x*-axis, taking $a_0(t)$ and $a_3(t)$ to be the angles that the object and image planes make to the *x*-axis (being 90° for all *t* for the surfaces to be rotationally symmetric about the *x*-axis), i.e. for reflection (for $i = 1$ and 2), is given by:

$$a_i(t)=\frac{d_i(t)}{2}+\frac{d_{i-1}(t)}{2}$$

wherein the values of $m_{i,x}(0)$ and $m_{i,y}(0)$ (for $i = 1$ and 2) are chosen so that the resulting mirror layout satisfies the sine criterion; wherein for a far away source (say along the negative *x*-axis, say $f = -10^9$) a scale parameter, *b* may be set equal to unity (without loss of generality, such that $B = b/p_0(0) = 1/p_0(0)$); wherein the sine criterion is then satisfied if:

$$m_{1,y}(0)=\pm\frac{m_{2,y}(0)}{\left(m_{2,x}(0)^2+m_{2,y}(0)^2\right)^{1/2}}$$

wherein iterating either from shallower angles to more oblique angles, or vice versa (switching between the two being achieved by using as seed values later iterated results and reversing the sign of the iteration step size *h*), such that if the iteration is from highly oblique angles, then set $m_{2,x}(0)$ equal to a small number close to zero, say 10^{-9}, and choose $m_{1,x}(0) = q_1$ and $m_{2,y}(0) = q_2$, where q_1 and q_2 are arbitrary real numbers (positive or negative), but with the choice of signs of q_1, q_2 and *h* constrained so

as not to have simultaneously the sign of q_1 negative, the sign of q_2 positive and the sign of h positive, then $m_{1,y}(0)$ will need to be ± 1 for the initial parameters to satisfy the sine criterion; and wherein without loss of generality it is possible to choose $m_{1,y}(0)$ to be -1;

wherein the sign Z is chosen so that the sine criterion remains satisfied as t changes;

wherein the values of $M_i(t)$ are updated as follows (for a small value of h):

$$M_i(t+1) \equiv \begin{pmatrix} m_{i,x}(t+1) \\ m_{i,y}(t+1) \end{pmatrix} = M_i(t) + w_i \begin{pmatrix} \cos(a_i(t)) \\ \sin(a_i(t)) \end{pmatrix} h$$

where $r_{i-1}(t) = \sin\left(a_{i-1}(t) - d_{i-1}(t)\right)$ $s_i(t) = \sin\left(a_i(t) - d_{i-1}(t)\right)$ and where

$$w_2 = \frac{p_1 r_0}{p_0 s_2} \quad w_1 = -ZB\frac{p_1 s_3}{p_2 r_1}$$

wherein the iteration is ended no later than when light rays cease to be able to pass freely through the mirror arrangement, once it has been rotated as in step (j); and

wherein the curves produced above are rotated around the x-axis to define the complete, three-dimensional mirror surfaces.

20. (Previously Presented) A low mass high numerical aperture imaging device (1) according to claim 19 comprising first and second axially symmetric curved mirrors (1a, 1b) adapted to concentrate sunlight, further comprising a solar thermal propulsion arrangement (1c) that creates direct thrust for powered flight by heating and expelling a propellant.

21-22. (Cancelled)

23. (Previously Presented) A low mass high numerical aperture imaging device (2) according to claim 19 comprising first and second axially symmetric curved mirrors (2a, 2b) adapted to create thrust in outer space by focusing incoming light photons into a small area, further comprising one or more mirrors (2c) that are used to deflect the focused light photons in a suitable direction away from the device, the thrust being generated by the deflection of the photons.

24. (Previously Presented) A high numerical aperture imaging device according to claim 19 adapted to concentrate electromagnetic radiation to a high temperature for the purpose of generating electric power.

25. (Previously Presented) A low mass device according to claim 24 adapted to generate electric power and to provide thrust for powered flight.

26. (Previously Presented) A low mass device according to claim 25 in which the thrust is provided by a balanced ion drive in which both positively and negatively charged ions are simultaneously propelled away from the device in suitable proportions to avoid a space charge building up around the device.

27. (Cancelled)

28. (Previously Presented) A high numerical aperture imaging device according to claim 19 comprising first and second axially symmetric curved mirrors for focusing the image of an object onto an image point, wherein the first and second curved mirrors are arranged to effectively create inwardly imploding dipole-like solutions to the applicable wave equation, to concentrate the energy flux arriving at the image plane from a given point in the object more than would be possible were the image formation to be subject to the diffraction limits that generally apply to far field devices.

29. (Previously Presented) A high numerical aperture imaging device according to claim 19 further comprising a partially transparent plane mirror positioned proximate to the image plane.

30. (Previously Presented) A device according to claim 29, further comprising a wave attenuation element and a wave polarisation-rotating element designed so that the spatial distribution of the amplitude and polarisation of a wavefront as it approaches the image plane is rendered more closely consistent with that required to generate dipole-like solutions to the wave equation.

31. (Previously Presented) A device according to claim 28 adapted to produce highly accurate lithographic images for use in semiconductor/microchip manufacture.

32. (Previously Presented) A device according to claim 19 adapted to concentrate or project light, or other waves, or physical entities (other than waves) satisfying equivalent 'ballistic' equations of motion.

33. (Previously Presented) A device according to claim 19 in which the first and second mirrors are not inherently structurally rigid, and are adapted to rotate about a common axis in operation in order to maintain their required shape.

34. (Previously Presented) A device according to claim 19 in which the first and second mirrors are not inherently rigid, and are adapted to be inflated in operation to attain their required shape.

35. (Previously Presented) A device according to claim 19 for interlinking of optical networking components, the device further comprising a solid state optical emitter or detector in the source/image plane, "optical" here to be understood to include infra-red, microwave and other sorts of electromagnetic radiation as well as visible light.

36. (Previously Presented) A device according to claim 19 in which the shape of the first and second mirrors is further modified to compensate for higher order aberrations by adjusting $M_0(t)$ and $M_3(t)$ in step (a) of claim 1 so that the centres of images of edges of a suitably sized circular or far away spherical object are at each step of the iteration more nearly centred on the point at which rays from the centre of such a circular or far away spherical object would strike the image plane.

37. (Previously Presented) A high numerical aperture device according to claim 19 further comprising one or more additional mirrors and/or refracting or diffracting surfaces, adapted to exhibit improved aberration characteristics.

38. (Previously Presented) A device according to claim 29 adapted to produce highly accurate lithographic images for use in semiconductor/microchip manufacture.

39. (Previously Presented) A device according to claim 30 adapted to produce highly accurate lithographic images for use in semiconductor/microchip manufacture.